Press Release
MAN Diesel

MAN Diesel's First VTA Application Achieves 10,000 Operating Hours

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In 2007, MAN Diesel's Business Unit Turbocharger, based in Augsburg, Germany, equipped the first engine in a commercial application with its VTA variable turbine area turbocharger technology and has been closely monitoring results according to a prescribed timetable.

The engine concerned is one of two 46 cm bore MAN B&W brand type 6S46MC-C installed aboard the 70,000 ton shallow draught tanker Stena President – for the purposes of direct comparison, only one of the tanker's engine is equipped with an axial type TCA55-2V turbocharger – the "V" suffix denotes the VTA version. The 6S46MC-C burns HFO, was built by MAN Diesel's Croatian licensee Brodosplit and features mechanically controlled fuel injection and mechanical exhaust valve actuation.

The Stena President's maiden voyage took place in late September 2007 and, as previously reported by MAN Diesel, an inspection of the VTA turbocharger at 3,000 hours was very satisfactory. This trend has now continued, with MAN Diesel reporting similarly favourable findings on the TCA55-2V at the 10,000 hour inspection in June 2009. The turbocharger has had a markedly positive effect on engine operation and has experienced no problems with its mechanisms due to fouling or wear in spite of operation on HFO.

At the 10,000 hour inspection, special attention was paid to minor modifications resulting from the 3,000 hour inspection, notably a new clamping system to ensure a gas tight circumferential seal at the nozzle ring cover. Although cover leakage was detected at the 3,000 hour inspection, MAN Diesel reports that the problem was not considered critical and the original design was kept in order to gain more operating hours on the original nozzle ring. Accordingly, modification was carried out at 10,000 hours.

Otherwise, internally, only minor fouling was detected at the nozzle ring inlet while the outlet proved very clean. The adjustable nozzle ring with its axial VTA vanes proved free-moving and smoothly adjustable.

The external inspection revealed residues of exhaust gas on the upper actuator unit, and traces of exhaust gas on the lower actuator unit. However, this issue had also been detected previously and a new design of actuator unit was fitted, modified to prevent exhaust gases entering its spindle case.

During the 10,000 hour inspection, the adjustable nozzle ring vanes – the major element of the VTA principle – were removed from their seats and both the surfaces of the bearing shafts of the vanes and the female bearing surfaces of the bearing seats cleaned and inspected. The preliminary inspection before cleaning showed that dry-lubricant was still present in sufficient quantities on both the vane shafts and the bearing seats.

After cleaning the bearing shaft surfaces were found to be smooth and still within their works dimensional tolerances. Only slight scratching was present on the inner ring. Likewise, the guide ring exhibited no wear. Given these excellent findings, a modified nozzle ring with improved gas tightness was not mounted in order to achieve more running hours on the original setup.
As well as confirming the reliable operation of the VTA system, an economic assessment of the effects of VTA technology on the operation of the 6S46MC-C revealed an extremely useful 4.5 g/kWh reduction in specific fuel oil consumption (SFOC).

Engine Speed [rpm]	Engine Load [%]	SFOC VTA off [l/h]	SFOC VTA on [l/h]	Reduction [l/h]	Reduction [%]
100	40	666	647	19	2.85
113	50	937	914	23	2.45
120	72	1114	1086	28	2.51
129	90	1427	1418	9	0.63

Further advantages established in terms of engine operation include confirmation of the ability to switch off the two-stroke engine's auxiliary blowers at 5% lower engine load due to the ca. 0.5 bar variation (increase) in turbocharger compressor output pressure at part load due to the VTA system. This benefit also led to a significant reduction in soot and smoke generation at part load.

Slow Steaming

The capabilities proven in the Stena President trials are, of course, extremely topical: in view of high fuel oil prices and low freight rates, ship owners and operators are reducing vessel speeds to save costs – so-called slow steaming. With VTA technology, charge air delivery can be precisely matched to the power output demanded from the engine at a given load condition. In this way there is no deterioration in the emissions behaviour of the engine and fuel consumption is saved not only by running the engine at a lower output, but also by optimising combustion at the appropriate load point.

VTA Technology

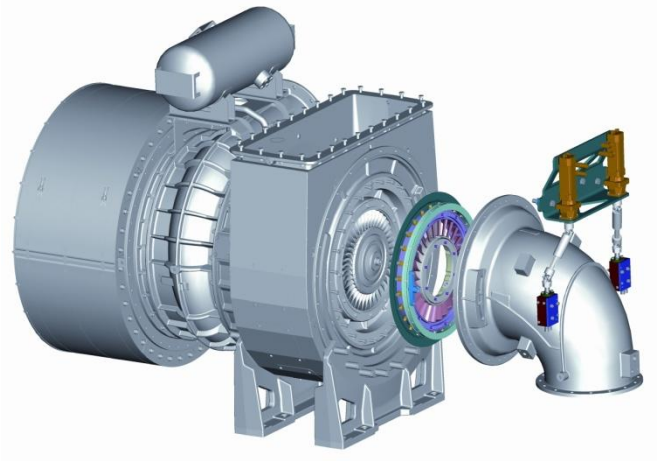
VTA denotes a system of adjustable nozzle ring vanes which replaces the fixed vane nozzle rings fitted in MAN Diesel's standard axial TCA and radial TCR turbochargers. Adjusting vane pitch regulates the pressure of the exhaust gases on the turbocharger turbine to vary the output of the compressor.

With VTA the quantity of charge air entering the cylinder can thus be more precisely matched to the quantity of fuel injected, so that combustion can be optimised at all points on the engine's operating profile. In this way specific fuel consumption and related emissions can be minimized at all engine speeds and loads, combined with improved dynamic behaviour of the engine-turbocharger system i.e. better engine response.

Control of vane position is fully electronic and a wide range of control signals can be used in both closed-loop control systems with feedback or open-loop systems with mapped vane adjustment. A comprehensive range of control signals can be used, for example charge air pressure after the compressor and exhaust gas temperature before and after the turbocharger. In this way, MAN Diesel states, it is confident that VTA turbochargers can be precisely tailored to a wide range of applications, including both mechanically and electronically controlled two and four stroke engines.

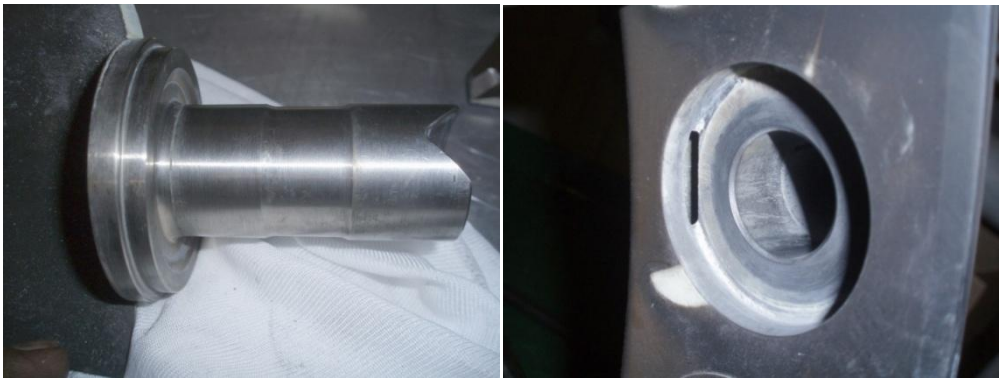
Retrofit

MAN Diesel also stresses that VTA technology can be readily retrofitted to turbochargers already in the field. For such applications the Turbocharger Business Unit offers complete upgrade packages including the VTA nozzle ring and the associated actuation and control systems.



VTA turbochargers from MAN Diesel feature a nozzle ring with adjustable vanes. Seen here is the axial variant for the TCA axial turbocharger. The system is modular and occupies the same position as a fixed nozzle ring. It can be retrofitted to turbochargers already in the field

The MAN Diesel axial TCA55-2V turbocharger with VTA technology on a six cylinder, 46 cm bore MAN B&W type 6S46MC-C two stroke engine aboard the shallow draught tanker Stena President. The VTA turbocharger recently achieved 10,000 operating hours. A thorough inspection revealed excellent findings



(left and right) After 10,000 operating hours in the TCA55-2V turbocharger with VTA technology, the bearing surfaces of both the adjustable nozzle ring vanes (left) and their seats (right) were still within their original works dimensional tolerances

The 70,000-ton, shallow-draught tanker Stena President is powered by two MAN B&W 6S46MC-C engines. For comparison, one engine is fitted with a TCA55 turbocharger featuring the VTA adjustable vane nozzle ring and the other with the standard, fixed nozzle ring

About MAN Diesel

MAN Diesel is the world's leading provider of large bore diesel engines for marine and power plant applications. The company designs two-stroke and four-stroke engines, generating sets, turbochargers, CP propellers and complete propulsion packages that are manufactured both by MAN Diesel and its licensees. The engines have power outputs ranging from 450 to 97,300 kW. MAN Diesel employs approx. 8,000 staff, primarily in Germany, Denmark, France, the Czech Republic, India and China. The global after-sales organisation, MAN Diesel PrimeServ, comprises a network of the company's own service centres, supported by authorised partners. MAN Diesel is a company of MAN SE, which is listed on the DAX share index of the 30 leading companies in Germany.

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